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updating examinations) and increases/decreases in variable costs due to inflation and other factors. In order to calculate increases/decreases in costs due to inflation, EPA may use one of the three following indices: the Federal General Schedule (GS) pay scale, the Consumer Price Index (CPI), and/or a component of the CPI, such as services. Second, EPA will estimate the number of participants for each program. At a minimum, these participation rates will be based on past and current program participation rates. Third, EPA shall calculate the per capita costs that individuals and organizations should pay to enable it to recover its fixed and variable costs each year for each program. EPA shall also consider potential industry impacts as it adjusts to levels to ultimately achieve full cost recovery over the period of five years.

[60 FR 41816, Aug. 14, 1995]

### § 195.30 Failure to remit fee.

EPA will not process an application or continue a participant's listing in the National Radon Measurement Proficiency program, individual proficiency component of the RMP program, or the National Radon Contractor Proficiency program until the appropriate remittance provided in § 195.20(a) has been received by EPA. Failure by a currently EPA-listed organization or individual to remit the required fees in a timely manner will result in the loss of that organization's or individual's listing status as specified in § 195.20(c).

## PART 197—PUBLIC HEALTH AND ENVIRONMENTAL RADIATION PROTECTION STANDARDS FOR YUCCA MOUNTAIN, NEVADA

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### Subpart A—Public Health and Environmental Standards for Storage

#### § 197.1 What does subpart A cover?

This subpart covers the storage of radioactive material by DOE in the Yucca Mountain repository and on the Yucca Mountain site.

#### § 197.2 What definitions apply in subpart A?

*Annual committed effective dose equivalent* means the effective dose equivalent received by an individual in one year from radiation sources external to the individual plus the committed effective dose equivalent.

*Committed effective dose equivalent* means the effective dose equivalent received over a period of time (e.g., 30

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years.), as determined by NRC, by an individual from radionuclides internal to the individual following a one-year intake of those radionuclides.

*DOE* means the Department of Energy.

*Effective dose equivalent* means the sum of the products of the dose equivalent received by specified tissues following an exposure of, or an intake of radionuclides into, specified tissues of the body, multiplied by appropriate weighting factors.

*EPA* means the Environmental Protection Agency.

*General environment* means everywhere outside the Yucca Mountain site, the Nellis Air Force Range, and the Nevada Test Site.

*High-level radioactive waste means:*

(1) The highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and

(2) Other highly radioactive material that the Commission, consistent with existing law, determines by rule requires permanent isolation.

*Member of the public* means anyone who is not a radiation worker for purposes of worker protection.

*NRC* means the Nuclear Regulatory Commission.

*Radioactive material* means matter composed of or containing radionuclides subject to the Atomic Energy Act of 1954, as amended (42 U.S.C. 2014 *et seq.*). Radioactive material includes, but is not limited to, high-level radioactive waste and spent nuclear fuel.

*Spent nuclear fuel* means fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing.

*Storage* means retention (and any associated activity, operation, or process necessary to carry out successful retention) of radioactive material with the intent or capability to readily access or retrieve such material.

*Yucca Mountain repository* means the excavated portion of the facility constructed underground within the Yucca Mountain site.

*Yucca Mountain site* means:

(1) The site recommended by the Secretary of DOE to the President under section 112(b)(1)(B) of the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10132(b)(1)(B)) on May 27, 1986; or

(2) The area under the control of DOE for the use of Yucca Mountain activities at the time of licensing, if the site designated under the Nuclear Waste Policy Act is amended by Congress prior to the time of licensing.

### § 197.3 How is subpart A implemented?

The NRC implements this subpart A. The DOE must demonstrate to NRC that normal operations at the Yucca Mountain site will and do occur in compliance with this subpart before NRC may grant or continue a license for DOE to receive and possess radioactive material within the Yucca Mountain site.

### § 197.4 What standard must DOE meet?

The DOE must ensure that no member of the public in the general environment receives more than an annual committed effective dose equivalent of 150 microsieverts (15 millirems) from the combination of:

(a) Management and storage (as defined in 40 CFR 191.2) of radioactive material that:

(1) Is subject to 40 CFR 191.3(a); and

(2) Occurs outside of the Yucca Mountain repository but within the Yucca Mountain site; and

(b) Storage (as defined in § 197.2) of radioactive material inside the Yucca Mountain repository.

### § 197.5 When will this part take effect?

The standards in this part take effect on July 13, 2001.

## Subpart B—Public Health and Environmental Standards for Disposal

### § 197.11 What does subpart B cover?

This subpart covers the disposal of radioactive material in the Yucca Mountain repository by DOE.

**§ 197.12 What definitions apply in subpart B?**

All definitions in subpart A of this part and the following:

*Accessible environment* means any point outside of the controlled area, including:

- (1) The atmosphere (including the atmosphere above the surface area of the controlled area);
- (2) Land surfaces;
- (3) Surface waters;
- (4) Oceans; and
- (5) The lithosphere.

*Aquifer* means a water-bearing underground geological formation, group of formations, or part of a formation (excluding perched water bodies) that can yield a significant amount of ground water to a well or spring.

*Barrier* means any material, structure, or feature that, for a period to be determined by NRC, prevents or substantially reduces the rate of movement of water or radionuclides from the Yucca Mountain repository to the accessible environment, or prevents the release or substantially reduces the release rate of radionuclides from the waste. For example, a barrier may be a geologic feature, an engineered structure, a canister, a waste form with physical and chemical characteristics that significantly decrease the mobility of radionuclides, or a material placed over and around the waste, provided that the material substantially delays movement of water or radionuclides.

*Controlled area* means:

- (1) The surface area, identified by passive institutional controls, that encompasses no more than 300 square kilometers. It must not extend farther:

- (a) South than 36° 40' 13.6661" north latitude, in the predominant direction of ground water flow; and

- (b) Than five kilometers from the repository footprint in any other direction; and

- (2) The subsurface underlying the surface area.

*Disposal* means the emplacement of radioactive material into the Yucca Mountain disposal system with the intent of isolating it for as long as reasonably possible and with no intent of recovery, whether or not the design of the disposal system permits the ready

recovery of the material. Disposal of radioactive material in the Yucca Mountain disposal system begins when all of the ramps and other openings into the Yucca Mountain repository are sealed.

*Ground water* means water that is below the land surface and in a saturated zone.

*Human intrusion* means breaching of any portion of the Yucca Mountain disposal system, within the repository footprint, by any human activity.

*Passive institutional controls* means:

- (1) Markers, as permanent as practicable, placed on the Earth's surface;
- (2) Public records and archives;
- (3) Government ownership and regulations regarding land or resource use; and
- (4) Other reasonable methods of preserving knowledge about the location, design, and contents of the Yucca Mountain disposal system.

*Peak dose* means the highest annual committed effective dose equivalent projected to be received by the reasonably maximally exposed individual.

*Performance assessment* means an analysis that:

- (1) Identifies the features, events, processes, (except human intrusion), and sequences of events and processes (except human intrusion) that might affect the Yucca Mountain disposal system and their probabilities of occurring during 10,000 years after disposal;

- (2) Examines the effects of those features, events, processes, and sequences of events and processes upon the performance of the Yucca Mountain disposal system; and

- (3) Estimates the annual committed effective dose equivalent incurred by the reasonably maximally exposed individual, including the associated uncertainties, as a result of releases caused by all significant features, events, processes, and sequences of events and processes, weighted by their probability of occurrence.

*Period of geologic stability* means the time during which the variability of geologic characteristics and their future behavior in and around the Yucca Mountain site can be bounded, that is, they can be projected within a reasonable range of possibilities.

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*Plume of contamination* means that volume of ground water in the predominant direction of ground water flow that contains radioactive contamination from releases from the Yucca Mountain repository. It does not include releases from any other potential sources on or near the Nevada Test Site.

*Repository footprint* means the outline of the outermost locations of where the waste is emplaced in the Yucca Mountain repository.

*Slice of the plume* means a cross-section of the plume of contamination with sufficient thickness parallel to the prevalent direction of flow of the plume that it contains the representative volume.

*Total dissolved solids* means the total dissolved (filterable) solids in water as determined by use of the method specified in 40 CFR part 136.

*Undisturbed performance* means that human intrusion or the occurrence of unlikely natural features, events, and processes do not disturb the disposal system.

*Undisturbed Yucca Mountain disposal system* means that the Yucca Mountain disposal system is not affected by human intrusion.

*Waste* means any radioactive material emplaced for disposal into the Yucca Mountain repository.

*Well-capture zone* means the volume from which a well pumping at a defined rate is withdrawing water from an aquifer. The dimensions of the well-capture zone are determined by the pumping rate in combination with aquifer characteristics assumed for calculations, such as hydraulic conductivity, gradient, and the screened interval.

*Yucca Mountain disposal system* means the combination of underground engineered and natural barriers within the controlled area that prevents or substantially reduces releases from the waste.

### § 197.13 How is subpart B implemented?

The NRC implements this subpart B. The DOE must demonstrate to NRC that there is a reasonable expectation of compliance with this subpart before NRC may issue a license. In the case of the specific numerical requirements in

§ 197.20 of this subpart, and if performance assessment is used to demonstrate compliance with the specific numerical requirements in §§ 197.25 and 197.30 of this subpart, NRC will determine compliance based upon the mean of the distribution of projected doses of DOE's performance assessments which project the performance of the Yucca Mountain disposal system for 10,000 years after disposal.

### § 197.14 What is a reasonable expectation?

Reasonable expectation means that NRC is satisfied that compliance will be achieved based upon the full record before it. Characteristics of reasonable expectation include that it:

(a) Requires less than absolute proof because absolute proof is impossible to attain for disposal due to the uncertainty of projecting long-term performance;

(b) Accounts for the inherently greater uncertainties in making long-term projections of the performance of the Yucca Mountain disposal system;

(c) Does not exclude important parameters from assessments and analyses simply because they are difficult to precisely quantify to a high degree of confidence; and

(d) Focuses performance assessments and analyses upon the full range of defensible and reasonable parameter distributions rather than only upon extreme physical situations and parameter values.

### § 197.15 How must DOE take into account the changes that will occur during the next 10,000 years after disposal?

The DOE should not project changes in society, the biosphere (other than climate), human biology, or increases or decreases of human knowledge or technology. In all analyses done to demonstrate compliance with this part, DOE must assume that all of those factors remain constant as they are at the time of license application submission to NRC. However, DOE must vary factors related to the geology, hydrology, and climate based upon cautious, but reasonable assumptions of the changes in these factors that could affect the

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Yucca Mountain disposal system over the next 10,000 years.

### INDIVIDUAL-PROTECTION STANDARD

#### § 197.20 What standard must DOE meet?

The DOE must demonstrate, using performance assessment, that there is a reasonable expectation that, for 10,000 years following disposal, the reasonably maximally exposed individual receives no more than an annual committed effective dose equivalent of 150 microsieverts (15 millirems) from releases from the undisturbed Yucca Mountain disposal system. The DOE's analysis must include all potential pathways of radionuclide transport and exposure.

#### § 197.21 Who is the reasonably maximally exposed individual?

The reasonably maximally exposed individual is a hypothetical person who meets the following criteria:

- (a) Lives in the accessible environment above the highest concentration of radionuclides in the plume of contamination;
- (b) Has a diet and living style representative of the people who now reside in the Town of Amargosa Valley, Nevada. The DOE must use projections based upon surveys of the people residing in the Town of Amargosa Valley, Nevada, to determine their current diets and living styles and use the mean values of these factors in the assessments conducted for §§ 197.20 and 197.25; and
- (c) Drinks 2 liters of water per day from wells drilled into the ground water at the location specified in paragraph (a) of this section.

### HUMAN-INTRUSION STANDARD

#### § 197.25 What standard must DOE meet?

The DOE must determine the earliest time after disposal that the waste package would degrade sufficiently that a human intrusion (see § 197.26) could occur without recognition by the drillers. The DOE must:

- (a) If complete waste package penetration is projected to occur at or before 10,000 years after disposal:

- (1) Demonstrate that there is a reasonable expectation that the reasonably maximally exposed individual receives no more than an annual committed effective dose equivalent of 150 microsieverts (15 millirems) as a result of a human intrusion, at or before 10,000 years after disposal. The analysis must include all potential environmental pathways of radionuclide transport and exposure; and

- (2) If exposures to the reasonably maximally exposed individual occur more than 10,000 years after disposal, include the results of the analysis and its bases in the environmental impact statement for Yucca Mountain as an indicator of long-term disposal system performance; and

- (b) Include the results of the analysis and its bases in the environmental impact statement for Yucca Mountain as an indicator of long-term disposal system performance, if the intrusion is not projected to occur before 10,000 years after disposal.

#### § 197.26 What are the circumstances of the human intrusion?

For the purposes of the analysis of human intrusion, DOE must make the following assumptions:

- (a) There is a single human intrusion as a result of exploratory drilling for ground water;
- (b) The intruders drill a borehole directly through a degraded waste package into the uppermost aquifer underlying the Yucca Mountain repository;
- (c) The drillers use the common techniques and practices that are currently employed in exploratory drilling for ground water in the region surrounding Yucca Mountain;
- (d) Careful sealing of the borehole does not occur, instead natural degradation processes gradually modify the borehole;
- (e) Only releases of radionuclides that occur as a result of the intrusion and that are transported through the resulting borehole to the saturated zone are projected; and
- (f) No releases are included which are caused by unlikely natural processes and events.

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### GROUND WATER PROTECTION STANDARDS

#### § 197.30 What standards must DOE meet?

The DOE must demonstrate that there is a reasonable expectation that, for 10,000 years of undisturbed perform-

ance after disposal, releases of radionuclides from waste in the Yucca Mountain disposal system into the accessible environment will not cause the level of radioactivity in the representative volume of ground water to exceed the limits in the following Table 1:

TABLE 1—LIMITS ON RADIONUCLIDES IN THE REPRESENTATIVE VOLUME

Radionuclide or type of radiation emitted	Limit	Is natural background included?
Combined radium-226 and radium-228 .....	5 picocuries per liter .....	Yes.
Gross alpha activity (including radium-226 but excluding radon and uranium).	15 picocuries per liter .....	Yes.
Combined beta and photon emitting radionuclides	40 microsieverts (4 millirem) per year to the whole body or any organ, based on drinking 2 liters of water per day from the representative volume.	No.

#### § 197.31 What is a representative volume?

(a) It is the volume of ground water that would be withdrawn annually from an aquifer containing less than 10,000 milligrams of total dissolved solids per liter of water to supply a given water demand. The DOE must project the concentration of radionuclides released from the Yucca Mountain disposal system that will be in the representative volume. The DOE must then use the projected concentrations to demonstrate a reasonable expectation to NRC that the Yucca Mountain disposal system complies with § 197.30. The DOE must make the following assumptions concerning the representative volume:

(1) It includes the highest concentration level in the plume of contamination in the accessible environment;

(2) Its position and dimensions in the aquifer are determined using average hydrologic characteristics which have cautious, but reasonable, values representative of the aquifers along the radionuclide migration path from the Yucca Mountain repository to the accessible environment as determined by site characterization; and

(3) It contains 3,000 acre-feet of water (about 3,714,450,000 liters or 977,486,000 gallons).

(b) The DOE must use one of two alternative methods for determining the dimensions of the representative volume. The DOE must propose its chosen method, and any underlying assumptions, to NRC for approval.

(1) The DOE may calculate the dimensions as a well-capture zone. If DOE uses this approach, it must assume that the:

(i) Water supply well(s) has (have) characteristics consistent with public water supply wells in the Town of Amargosa Valley, Nevada, for example, well-bore size and length of the screened intervals;

(ii) Screened interval(s) include(s) the highest concentration in the plume of contamination in the accessible environment; and

(iii) Pumping rates and the placement of the well(s) must be set to produce an annual withdrawal equal to the representative volume and to tap the highest concentration within the plume of contamination.

(2) The DOE may calculate the dimensions as a slice of the plume. If DOE uses this approach, it must:

(i) Propose to NRC, for its approval, where the location of the edge of the plume of contamination occurs. For example, the place where the concentration of radionuclides reaches 0.1% of the level of the highest concentration in the accessible environment;

(ii) Assume that the slice of the plume is perpendicular to the prevalent direction of flow of the aquifer; and

(iii) Assume that the volume of ground water contained within the slice of the plume equals the representative volume.

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### ADDITIONAL PROVISIONS

#### **§ 197.35 What other projections must DOE make?**

To complement the results of § 197.20, DOE must calculate the peak dose of the reasonably maximally exposed individual that would occur after 10,000 years following disposal but within the period of geologic stability. No regulatory standard applies to the results of this analysis; however, DOE must include the results and their bases in the environmental impact statement for Yucca Mountain as an indicator of long-term disposal system performance.

#### **§ 197.36 Are there limits on what DOE must consider in the performance assessments?**

Yes. The DOE's performance assessments shall not include consideration of very unlikely features, events, or processes, i.e., those that are estimated to have less than one chance in 10,000 of occurring within 10,000 years of disposal. The NRC shall exclude unlikely features, events, and processes, or sequences of events and processes from

the assessments for the human intrusion and ground water protection standards. The specific probability of the unlikely features, events, and processes is to be specified by NRC. In addition, unless otherwise specified in NRC regulations, DOE's performance assessments need not evaluate, the impacts resulting from any features, events, and processes or sequences of events and processes with a higher chance of occurrence if the results of the performance assessments would not be changed significantly.

#### **§ 197.37 Can EPA amend this rule?**

Yes. We can amend this rule by conducting another notice-and-comment rulemaking. Such a rulemaking must include a public comment period. Also, we may hold one or more public hearings, if we receive a written request to do so.

#### **§ 197.38 Are the Individual Protection and Ground Water Protection Standards Severable?**

Yes. The individual protection and ground water protection standards are severable.